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(54) Title: MESSAGE-BASED OCR SERVER
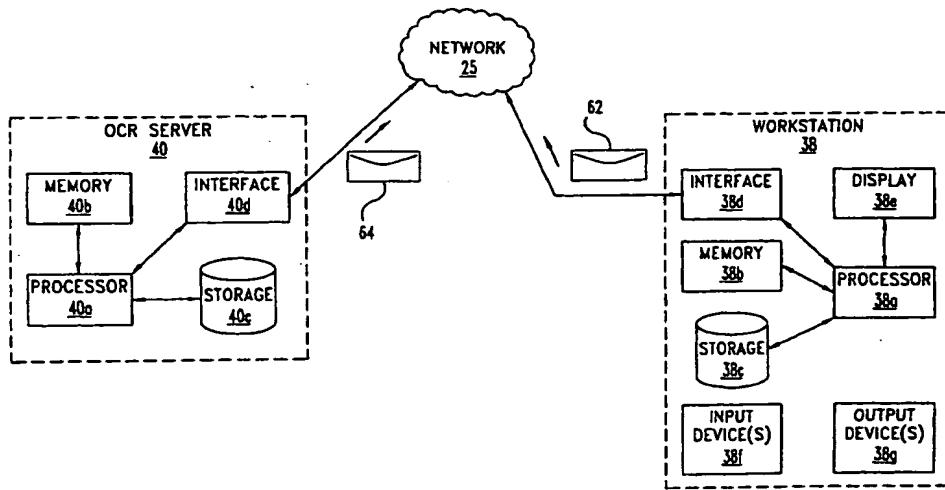
(57) Abstract: A novel OCR server (40) provides optical character recognition (OCR) service to remote networked computers and users. In some embodiments, a remote computer (38) sends to the OCR server (40) a message (62) that includes a return address and one or more images. OCR Server (40) converts at least part of the image(s) into text, which is sent in a second message (64) back to the originator of the first message. In some embodiments messages are of a standard format.

MESSAGE-BASED OCR SERVER

REFERENCE TO RELATED APPLICATIONS

Benefit is claimed under 35 U.S.C. § 119(e) based on U.S. Provisional Patent
Application No. 60/143,464, filed on July 13, 1999, which is incorporated by
5   reference as if fully set forth herein.

BACKGROUND

The present invention relates to optical character recognition systems, and
more particularly, but not exclusively, relates to network-based image-to-text
translation systems.

10   Optical character recognition technology (for translating image data into
text) has become more useful in recent years as the communication demands of
individuals and organizations have grown. Traditional OCR applications, such as
conversion of facsimile pages to editable text, have continued to grow in use.

In addition, the available forms of communication systems have
15   proliferated. In some systems, the front page of each received facsimile
transmission is converted to text and analyzed to determine the intended recipient
within an organization. The facsimile images are then forwarded via electronic
mail to that recipient.

In other systems, facsimile transmissions are received by a service bureau's
20   computer. The recipient (a subscriber of the service bureau) can then call that
computer by telephone, receive notice of the facsimile, and have the computer read
an OCR translation of the facsimile.

With the increasingly widespread use of OCR technology, software
developers have continued to improve the quality and speed of OCR software by
25   investing further resources in research and development of OCR technology. As a
result, the cost of OCR software has remained substantial, maintaining the need for
more efficient ways of using OCR technology.

SUMMARY

It is thus an object of the present invention to provide a more efficient system and method for using OCR technology in a networked computer environment. A further object of the present invention is to provide a message-based OCR server

5   designed to receive an image-bearing message from a remote computer, converting at least a part of the image to text, then returning the text to the source of the original message. In some embodiments of this form of the invention, the server refuses to perform the requested operation if the address of the remote computer fails to meet one or more criteria.

10   In another form of the present invention, a system is provided, comprising a computer network; a first message, carried from an originating entity to the server computer over the network, comprising image data; and a second message that (i) is responsive to the first message, (ii) is carried from the server computer to the originating entity over the network, and (iii) comprises text data corresponding to

15   at least a portion of the image data. In one embodiment of this form, the originating entity is a human user with an electronic mailbox, the first message includes the address of the mailbox, and the second message is sent to the originating entity using the address. In another embodiment, the originating entity is a computer workstation. In yet another embodiment, the first message and

20   second message have a format compliant with a messaging standard, such as RFC 822.

In another form of the present invention, a method is given for providing a centralized OCR processing resource that accepts messages containing images, then replies to the sender with text taken from at least part of the image. In some

25   forms of the present invention, this service is provided synchronously. In other forms, it is provided asynchronously.

In some embodiments, the present invention will provide OCR service to devices that lack the computing power (e.g., memory, processing speed, or complexity) to perform OCR operations on their own.

30   In other embodiments, the present invention reduces the licensing cost involved in providing OCR service to a set of networked computers.

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In still other embodiments, the present invention reduces processing demand on networked computers requiring OCR service.

Further forms, objects, features, aspects, benefits, advantages, and embodiments of the present invention shall become apparent from the detailed description and

5　　drawings provided herewith.

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BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic view of a system according to one embodiment of the present invention.

FIG. 2 is a schematic view of certain components of a system according to one embodiment of the present invention.

FIG. 3 is a flow chart of OCR service according to one embodiment of the present invention.

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DETAILED DESCRIPTION OF SELECTED EMBODIMENTS

For the purpose of promoting an understanding of the principles of the invention, reference will now be made to the embodiments illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be

5   understood that no limitation of the scope of the invention is thereby intended. Any alterations and further modifications in the described embodiments, and any further applications of the principles of the invention as described herein are contemplated as would normally occur to one skilled in the art to which the invention relates.

10   In the example embodiment discussed in the following paragraphs, a centralized computing resource, connected by a network to other computers, performs OCR functions. Other computers in the network send messages of one or more types to the "OCR Server" computer. These messages contain or refer to images. The OCR Server converts at least part of the image(s) into text, which is then returned

15   to the original sender in a second message. The messages may take standard or non-standard forms. The sender may be a human user of the system or a device.

FIG. 1 shows system 20, an exemplary embodiment of the present invention, in schematic form. In this embodiment, network 25 connects various computers and workstations 30, 32, 34, 36 and 40, which have number,

20   composition, and configuration as discussed below. Workstations 30, 32, and 34 provide different functionality in the computer system 20. For example, computer 30 is a word processing workstation, workstation 32 is a scanning workstation, and workstation 34 is an image indexing workstation. Messaging server 36 is an electronic mail gateway between network 25 and network 50. Messaging server 36

25   receives messages from other computers connected to or through network 50 and distributes them to users of network 25. In the present exemplary embodiment, messaging server 36 provides additional functionality as described below.

Also connected to network 25 is OCR Server 40, which will now be described with continuing reference to FIG. 1, and additional reference to FIG. 2. In this

30   exemplary embodiment, OCR Server 40 comprises processor 40a, memory 40b, storage 40c, and interface 40d. In other implementations, OCR Server 40 might also include input devices, output devices, and/or other components as desired in

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those implementations. Processor 40a may be comprised of one or more components configured as a single unit. Alternatively, when of a multi-component form, processor 40a may have one or more components located remotely relative to the others. One or more components of processor 40a may be of the electronic

5   variety defining digital circuitry, analog circuitry, or both. In one embodiment, processor 40a is of a conventional, integrated circuit microprocessor arrangement, such as one or more PENTIUM II or PENTIUM III processors supplied by INTEL Corporation of 2200 Mission College Boulevard, Santa Clara, California, 95052, USA.

10   Memory 40b may include one or more types of solid-state electronic memory, magnetic memory, or optical memory, just to name a few. By way of non-limiting example, memory 40b may include solid-state electronic Random Access Memory (RAM), Sequentially Accessible Memory (SAM) (such as the First-In, First-Out (FIFO) variety or the Last-In First-Out (LIFO) variety), Programmable Read Only

15   Memory (PROM), Electrically Programmable Read Only Memory (EPROM), or Electrically Erasable Programmable Read Only Memory (EEPROM); an optical disc memory (such as a DVD or CD ROM); a magnetically encoded hard disc, floppy disc, tape, or cartridge media; or a combination of any of these memory types. Also, memory 40b may be volatile, nonvolatile, or a hybrid combination of

20   volatile and nonvolatile varieties.

In this exemplary embodiment, storage 40c comprises one or more of the memory types just given for memory 40b, preferably selected from the non-volatile types. Interface 40d, preferably a network interface card (NIC) of the well known type, provides for data exchange between workstation 40 and other devices via network

25   25.

Workstation 38 in this exemplary embodiment includes processor 38a, memory 38b, storage 38c, and interface 38d, each of one or more types as described for corresponding components of OCR Server 40. Workstation 38 also includes display 38e, one or more additional input devices 38f, and one or more additional

30   output devices 38g as required or desired in a particular implementation. Optional input devices 38f include, for example, a keyboard, mouse, trackball, light pen, scanner and/or microphone, to name just a few representative examples. Optional

output devices 38g include, but are not limited to, audio output devices and/or a printer. Input devices 38f and output devices 38g may be connected to other devices in workstation 38 with any suitable means and configuration known in the art.

5   In this embodiment of the present invention, workstation 38 sends to OCR Server 40 a message 62. Message 62 contains a "return address" (the address of workstation 38), to which OCR Server 40 will send its reply. The reply message 64 is generated as discussed below (see FIG. 3) and returned to workstation 38 via network 25. Messages 62 and 64 preferably use standard message protocols, such

10   as RFC 822, maintained by the Internet Engineering Task Force (IETF) with MIME (Multipurpose Internet Mail Extensions) extensions described in RFC 1341 and other (additional and superseding) standards documents of the IETF.

An interaction using this exemplary embodiment will now be disclosed with reference to FIG. 3, and with continuing reference to the components shown in

15   FIGS. 1 and 2. Method 100 begins at start block 101, then OCR Server 40 determines (decision block 103) whether a message has been received. If it has not, the method 100 returns to the entry point of decision block 103 and waits for a message to arrive.

When a message does arrive at OCR Server 40, OCR Server 40 parses the message

20   (block 105) to obtain the identity of the originator of the message, and one or more images that are enclosed with, attached to, or referenced by (for example, using a uniform resource locator (URL)) the message. This step may also include decoding one or more parts of the message that had been MIME-encoded to obtain an image file format suitable for input into an OCR application or routine. The

25   identity of the originator of the message is then used in the authentication of, and accounting for, the OCR services to be rendered. Error handling (not shown) using methods well known in the art may be added at this stage of method 100. For example, a list of entities that are allowed to use the OCR Server 40 is stored in storage 40c, then accessed after each message is parsed. If the sending entity is not

30   on the list, OCR Server 40 refuses to provide conversion service.

The decoded image is then processed by an OCR application or program routine to yield text (block 107). For example, if the image included in message 62 is a

scanned image of a typed document, the text obtained at block 107 might be the same as (or approximately the same as) the text of the original document page. The text thus obtained (at block 107) is returned (block 109) to the sender of the original message 62 in reply message 64. When the reply message 64 has been

5   sent, OCR Server 40 determines (decision block 111), using methods known in the art, whether to halt processing. Upon a negative determination at decision block 111, process 100 returns to the entry point of decision block 103. Upon a positive result, processing ends at end block 119.

In some embodiments of the present invention, the originator of message 62 is

10   another workstation connected to network 25. In some of these embodiments, OCR services are provided by OCR Server 40 on a synchronous basis, so that processing on the originating workstation (or execution of a particular process or thread) is halted, or "blocked," until the reply message 64 is received. In others of these embodiments, OCR is performed asynchronously, wherein the sending

15   computer continues processing while OCR Server 40 performs the OCR.

In other embodiments of the present invention, a human user may be treated as the originator of message 62. In these embodiments, message 62 comprises a return address for the user (e.g., an e-mail address) along with the image to be converted. After conversion of the image, OCR Server 40 sends the converted text in message

20   64 to the originator's e-mail address.

In still other embodiments, one or more scanning workstations 32 each comprise a scanner. Images scanned by the scanner are attached to a message 62, which is sent to OCR Server 40. The text returned by OCR Server 40 in reply message 64 to the scanning workstation 32 is handled as necessary or desired.

25   In yet other embodiments, one or more image indexing workstations 34 step sequentially through a plurality of image files (not shown), sending a reference to each in a message 62 to OCR Server 40. The text in the resulting reply message 64 is used to create an index of the images using techniques known in the art.

In some preferred embodiments, messaging server 36 accepts electronic mail

30   messages from remote users (not shown) who are connected to or through network 50. Messaging server 36 may optionally provide error checking (for example, by filtering the messages to allow only messages from certain users or computers to

pass and/or by checking for properly formatted image attachments). Messaging server 36 then formats the electronic mail messages as image-bearing messages 62 to OCR Server 40 for processing. The reply messages 64 from OCR Server 40 are forwarded by messaging server 36 as electronic mail replies to the remote users.

5   In some forms of the invention, the OCR service discussed herein is part of a broader communication and interaction management system. In one such form, the functionality described in relation to block 107 in FIG. 3 may be performed by one software and/or hardware module, while other functionality is performed by one or more other software and/or hardware modules in the communication and

10   interaction management system. In other such forms, messaging, formatting, OCR processing, filtering, and other tasks described herein are divided in different ways among various hardware and/or software elements.

All publications, patents, and patent applications cited in this specification are herein incorporated by reference as if each individual publication, patent, or patent

15   application were specifically and individually indicated to be incorporated by reference and set forth in its entirety herein. While the invention has been illustrated and described in detail in the drawings and foregoing description, the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and

20   that all changes, equivalents, and modifications that come within the spirit of the inventions defined by the following claims are desired to be protected.

10

What is claimed is:

1. An apparatus, comprising a processor and a computer-readable medium encoded with programming instructions, said programming instructions being executable by said processor to:

5   receive a first message from a remote computer, the first message comprising image data;

        convert at least a portion of the image data into text data; and

        send a second message to the remote computer, the second message comprising the text data.

10   2. The apparatus of claim 1, wherein said remote computer has a remote computer identifier and said programming instructions are further executable by said processor to:

        access a list of acceptable computer identifiers;

        refuse to perform said conversion operation when the remote computer

15   identifier is not in the list of acceptable computer identifiers.

3. The apparatus of claim 1, wherein the image data is MIME-encoded.

4. A system, comprising:

        a computer network;

        an originating entity operatively interfaced with said network;

20   a server computer connected to said network;

        a first message, carried from said originating entity to said server computer over said network, comprising image data; and

        a second message that

                is responsive to said first message,

25   is carried from said server computer to said originating entity over said network, and

comprises text data corresponding to at least a portion of said
image data.

5.   The system of claim 4, wherein:
        said originating entity is a human user having an electronic mail box with
5   an address;
        said first message further comprises said address; and
        said second message is sent to said originating entity via said address.

6.   The system of claim 4, wherein said originating entity is a computer
workstation.

10   7.   The system of claim 4, wherein said first message and said second message
have a format compliant with a messaging standard.

8.   The system of claim 7, wherein the messaging standard is RFC 822.

WORKSTATION 34

WORKSTATION 32

WORKSTATION 30

NETWORK 50

MSG SVR 36

NETWORK 25

OCR SVR 40

20

Fig. 1

WORKSTATION 38

DISPLAY 38e

PROCESSOR 38a

OUTPUT DEVICE(S) 38g

INTERFACE 38d

MEMORY 38b

STORAGE 38c

INPUT DEVICE(S) 38f

62

NETWORK 25

64

OCR SERVER 40

INTERFACE 40d

STORAGE 40c

MEMORY 40b

PROCESSOR 40a

Fig. 2

100

START — 101

103

MSG.
RECEIVED
? → NO

YES

PARSE MESSAGE
105

CONVERT IMAGE
TO TEXT
107

RETURN TEXT TO
ORIGINAL SENDER
109

NO ← HALT
?
111

YES

END — 119
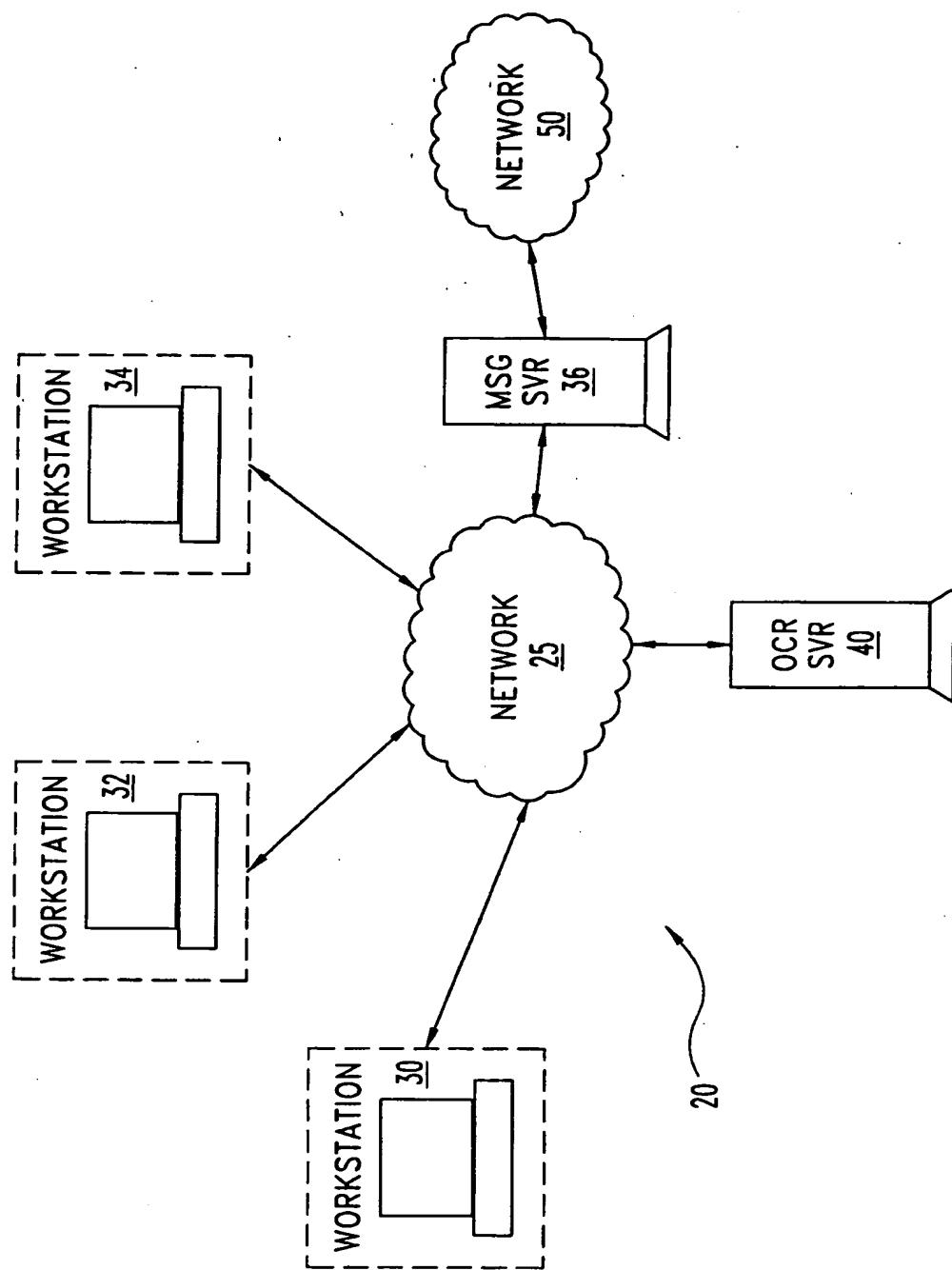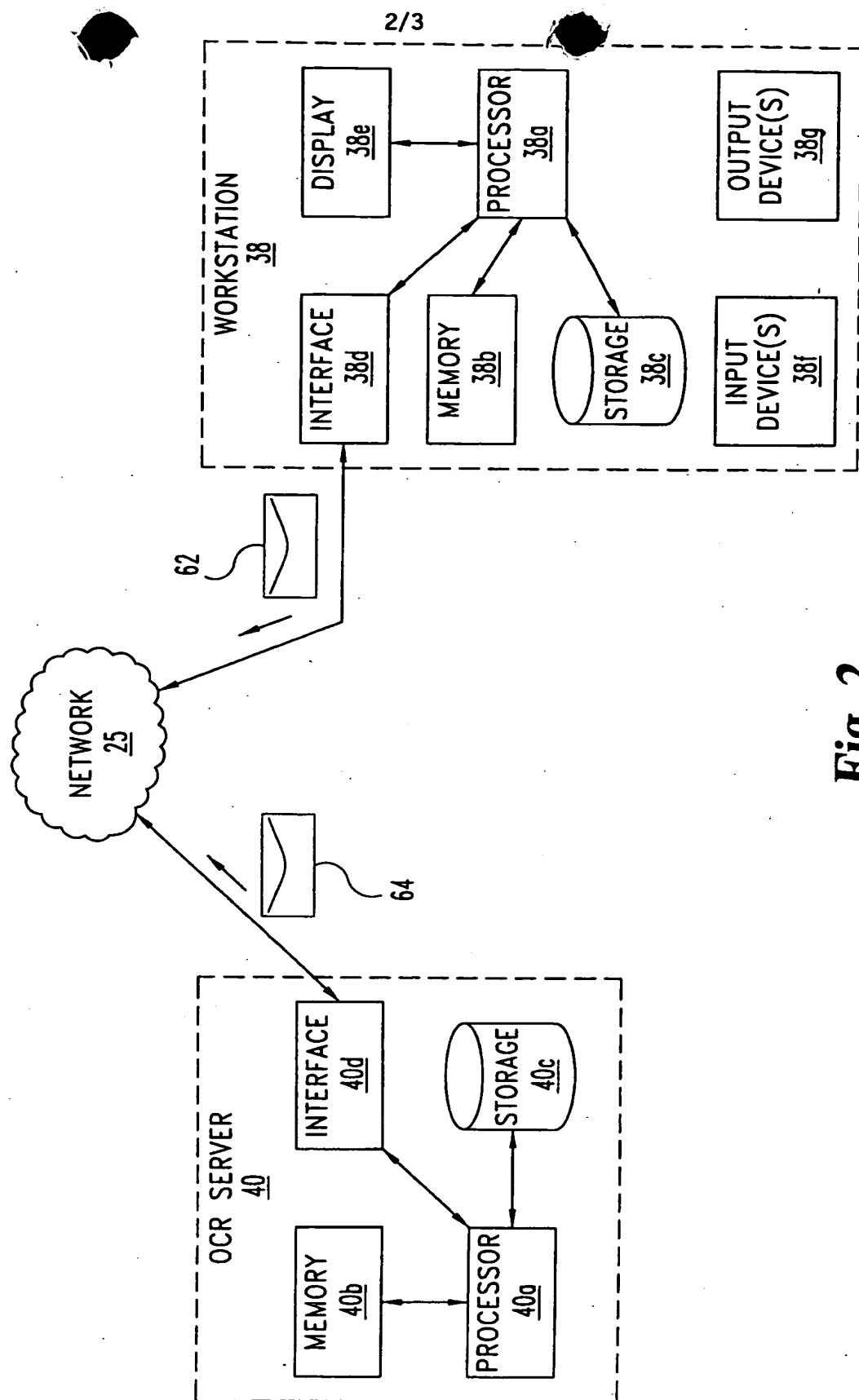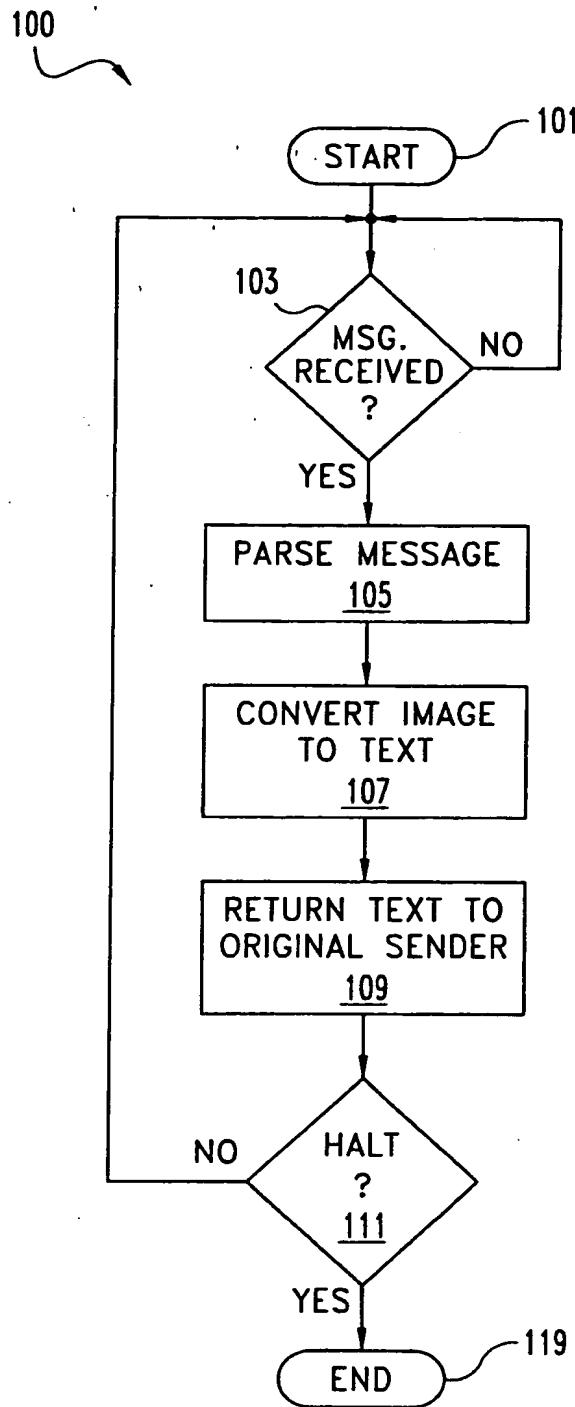
Fig. 3

International application No.

PCT/US00/19142

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7)   :G06F 15/16
US CL   : 709/206

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. :   709/206

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

OCR program manual

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

West database, DWPI, JPAB, EPAB, TDBD

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5,333,266 A (BOAZ et al) 26 July 1994, col. 5 line 27 et seq, col. 7 line 43 et seq, and col. 8 line 43 et seq.	1-8
Y	US 5,461,488 A (WITEK) 24 October 1995, col. 6 line 31 et seq.	1-8

☐ Further documents are listed in the continuation of Box C.   ☐ See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	
"E"	earlier document published on or after the international filing date	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	
		"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"O"	document referring to an oral disclosure, use, exhibition or other means	
"P"	document published prior to the international filing date but later than the priority date claimed	"&"	document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
29 AUGUST 2000	**25 OCT 2000**

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